



Montana Office of Public Instruction
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www.opi.mt.gov/IndianEd

Mathematics Lesson Plan

Reservation Land Areas

Grade 9/10 – Approximate Duration: 100 minutes

Stage 1 Desired Results

Established Goals:

MT Mathematics Standard 5 Benchmark 2: Use dimensional analysis to check reasonableness of procedures.

MT Mathematics Standard 5 Benchmark 4: Apply the appropriate concepts of estimates in measurement, error in measurement, tolerance, and precision.

IEFA: Essential Understanding 4: Reservations are lands that have been reserved by the tribes for their own use through treaties, statutes, and executive orders and were not “given” to them. The principle that land should be acquired from the Indians only through their consent with treaties involved three assumptions:

- I. Both parties to treaties were sovereign powers.
- II. Indian tribes had some form of transferable title to the land.
- III. Acquisition of Indian lands was solely a government matter not to be left to individual colonists.

Understandings:

Students will understand...

- how the size of one reservation has reduced over a period of years.
- how to make accurate measurements to calculate the area of a figure.
- how to calculate the area of irregular shapes by determining the common polygonal shapes that make up the irregular shape.
- how to convert square centimeter or square inch areas to the number of square miles by using the scale provided on the map.
- how to convert a square mile area into acres.
- how to compare calculated results to given results and check for reasonableness.

Essential Questions:

- What regular shapes could be used to estimate the area of the irregular shaped reservations?
- What measurements are needed in order to calculate the area of each reservation?
- Is there more than one approach that could be used to convert the map area into acreage area?
- Is there any relationship between the number of enrolled members and the land area set aside for their reservation?
- Are the calculated acreage amounts reasonable in comparison with reported information?

Stage 2 Assessment Evidence

Performance Tasks: Worksheet with geometric shapes and Montana maps or Montana reservation maps. Worksheet with questions answered and turned in.

Other Evidence: Participation with group discussion. Observation of students taking measurements and calculating the areas of their reservation regions. Individual questioning of students.

Stage 3 Learning Plan

Learning Activities:

1. State the “Understandings” for the lesson.
2. Introduction Activity:
 - Show the “Shrinking Reservation” Map changing applet. After each year is selected ask the following questions:
 - What is your estimation for the size change of the land area from the previous treaty?
 - What commonly used polygonal shape(s) do you believe would best estimate the reservation shape at each treaty change?
3. Handout the Irregular Shapes worksheet. Have students calculate the area of each shape.
4. Discuss answers of possible areas for each of the shapes.
 - What are some ways the shape could have been sectioned into in order to estimate the area?
 - What measurements would be needed to calculate the area by the method you chose for estimating the area of your shape?
5. Have students complete questions #1 - #3 on the Reservation Land Acreage Worksheet.
6. Handout MT Reservation maps.
 - Divide class into seven groups. Each group needs a map of their reservation for each member.
 - Have groups calculate the area of their assigned reservation. Each group member calculates to check for accuracy.
7. Have students complete questions #4 - #6 on the Reservation Land Acreage Worksheet.
8. Discussion with students regarding converting areas in square inches or square centimeters into the number of acres represented.
 - What is the relationship of our selected unit of measure to that of acres?
 - How will we convert our area measurement into the number of acres represented? Have groups convert their areas into acreage amounts.
9. Have students complete question #7 on the Reservation Land Acreage Worksheet.
10. Handout the overview of each MT reservation and discuss if their acreage calculation was close to the reported acreage.
 - What may be the contributing factors that resulted in different acreage amounts?
 - How do we know if our calculations are reasonable?
11. Have students complete questions #8 - #9 on the Reservation Land Acreage Worksheet.
12. Discuss student responses to questions #8-#9.
13. Turn in worksheet.

Summary: You have calculated areas of irregular shapes and applied that knowledge to find an area of a reservation. You have also compared a calculated value to a documented value to determine reasonableness of the result. In addition to the mathematical focus, you have been introduced to some details of your specific tribe(s). You should now be able to apply your knowledge of irregular shapes to determine the area of any region.

Materials/Resources Needed:

- Access to the website <http://www.trailtribes.org/greatfalls/shrinking-reservation.htm> for “The Shrinking Reservation” map series. At the trailtribes.org site, click on the map **Changes to Blackfeet Reservation** that is shown on the next page. It can be located at

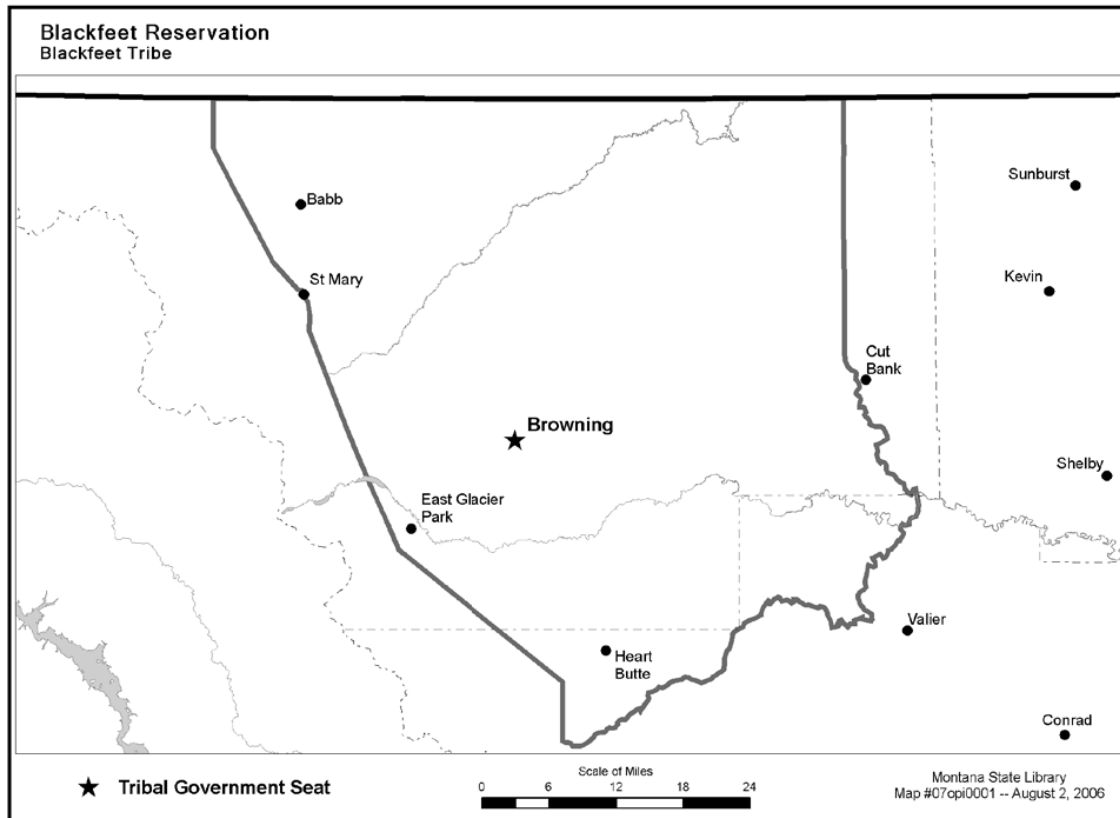
Reservation Land Areas (continued)

- <http://www.trailtribes.org/greatfalls/sites/showonecontent.asp@contentid3612.htm>
- Contact information for the physical maps showing the similar changes in the Blackfeet Reservation are available at the website (<http://www.regionalllearningproject.org>).
- Irregular Shape Worksheet for each student.
- Copies of MT reservation and copies of the overview of the seven Montana Reservations, one per group. (<http://www.opi.mt.gov/indianed/studentbackgroun.html> & <http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>).

Extensions to the lesson: : This lesson could be used in an Algebra 2 class while most juniors taking Algebra 2 will also be taking U.S. History. This lesson could be a collaborative lesson with the high school history teacher while the juniors are studying the reservation policies and different tribes. This way the students could be using information that they are discussing and researching along with the mathematics calculations to complete a unit. The students could be asked to find the enrollment number of tribal members of the reservation and any other item specific to their assigned reservation. The treaties that affected the reservation size should be noted in their presentations also. Students could create a power point presentation OR some visual type of poster and oral presentation to show all of their information to the entire class.

A second extension could be to focus only on the change in land area of the Blackfoot Territory through out the treaty years. The contact information to acquire those maps is listed in the resources above. Looking at the percentage change over the times of the treaty changes is quite interesting. Most of the written information about size of the other reservations is not as easily determined. Currently there are not maps available to illustrate those changes. The changes are explained in terms of landmarks but not located on any usable map.

Blackfeet Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Blackfeet Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Blackfeet Reservation is located in Northeastern Montana along the eastern slopes of the Rocky Mountains. It is bounded on the north by the United States-Canadian boundary and extends 52 miles south to Birch Creek. The foothills of the Rockies form the western boundary and the eastern boundary approximates an imaginary line, which starts near the junction of Cut Bank Creek and the Marias River and extends northward. Within these boundaries, the land is mainly high, rolling prairies interspersed with rivers and creeks. The mountains found along the western border range in altitude between 4,400 to 9,600 feet. Browning, the gateway to Glacier National Park, is an incorporated town on the reservation. It has been the headquarters of the Blackfeet Indian Agency since 1894 and is the principal shopping center on the reservation. Other communities located throughout the reservation include East Glacier, Babb, St. Mary, Starr School, and Heart Butte.

Population

Enrolled Members living on or near the Blackfeet Reservation 8,485

Enrolled Members living off the Blackfeet Reservation 6,633

Total number of enrolled Tribal members 15,118

Land Status

Total acres within the Reservation's Boundary 1,525,712 acres

Individually allotted lands 701,815.57 acres

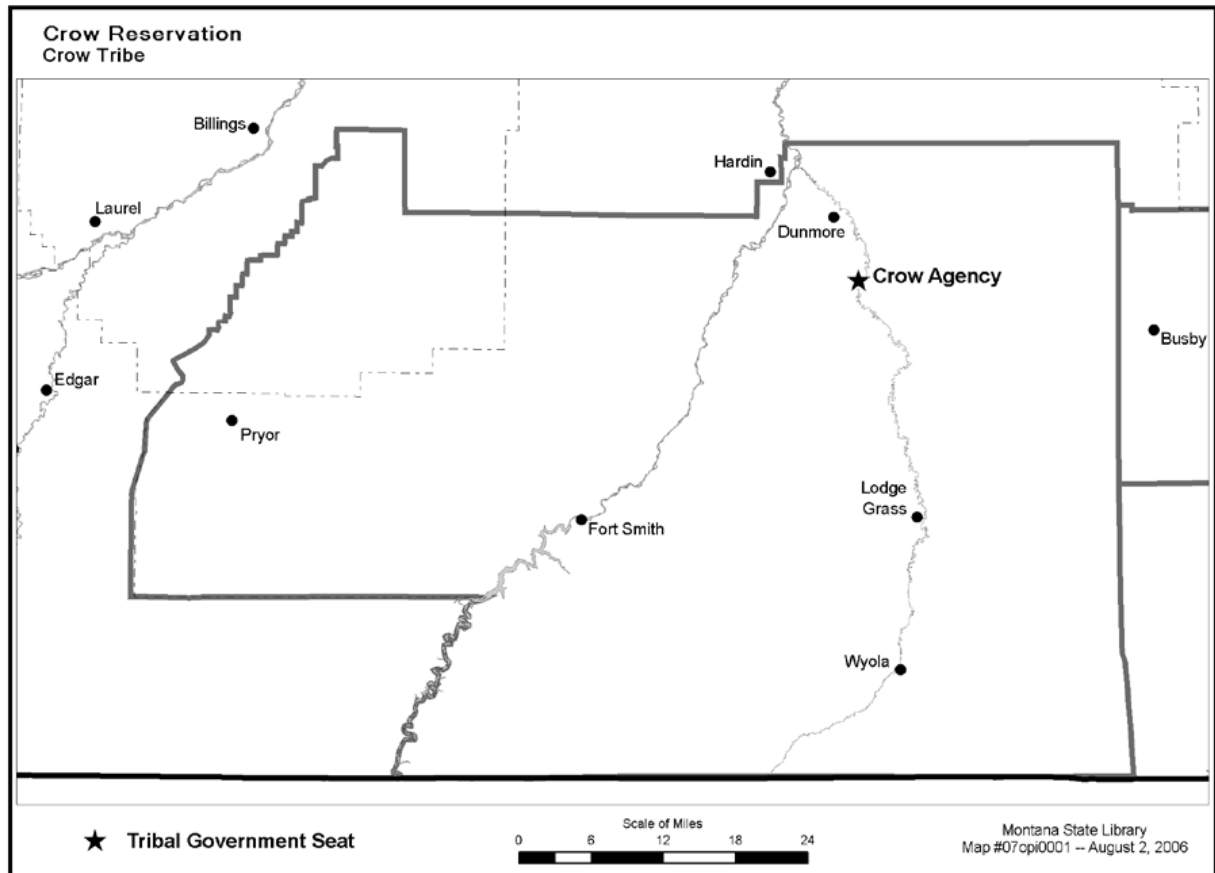
Tribally owned lands 311,174.98 acres

Government lands 1,654.46 acres

Fee title or state lands 511,067.10 acres

Presently, the land is used for ranching, farming, oil and gas development, and harvesting timber. The principal crops are wheat, barley, and hay. It is believed that traditional territorial lands of the Blackfoot Confederacy extended from the North Saskatchewan River south to Yellowstone Park, their western boundary being the Rocky Mountains and extending to the eastern boundary of Montana following the Missouri River.

Crow Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Crow Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Crow Indian Reservation encompasses a 4,989 square mile area or 3.8 million acres mainly in Big Horn County, in south central Montana. The Crow Reservation is nearly the same size as the entire state of Connecticut. The Crow Reservation is divided into six districts for cultural and Crow governmental purposes. They are: Reno, Lodge Grass, Pryor, St. Xavier, Wyola, and Black Lodge districts. The Crow Reservation has three mountainous areas, the Big Horn Mountains and the Pryor Mountains to the south/southwest, and the Wolf Teeth Mountains to the southeast. These mountain ranges meet the plains and valleys producing varied topography. In addition to the high mountains, the reservation includes gravely or stony slopes, broad hilltops with soils generally capable of supporting and maintaining excellent vegetative cover, level and productive irrigated valleys along the Big Horn and Little Big Horn Rivers and Pryor Creek, deep canyons, and extensive areas of rolling plateau. The nearest service center is Hardin, Montana, immediately adjacent to the reservation's northern boundary where restaurants, shops, and motels are available. However, the biggest retail and business center for the Crow Tribe is Billings located 90 miles north of Crow Agency, Montana.

Population

Tribal Members living on or near the Crow Reservation 7,153

Tribal Members living off the Crow Reservation 3,180

Total number of enrolled Tribal members 10,333

Land

Total acres within the Reservation's boundary 2,464,914 acres

Individually allotted lands 1,166,406 acres

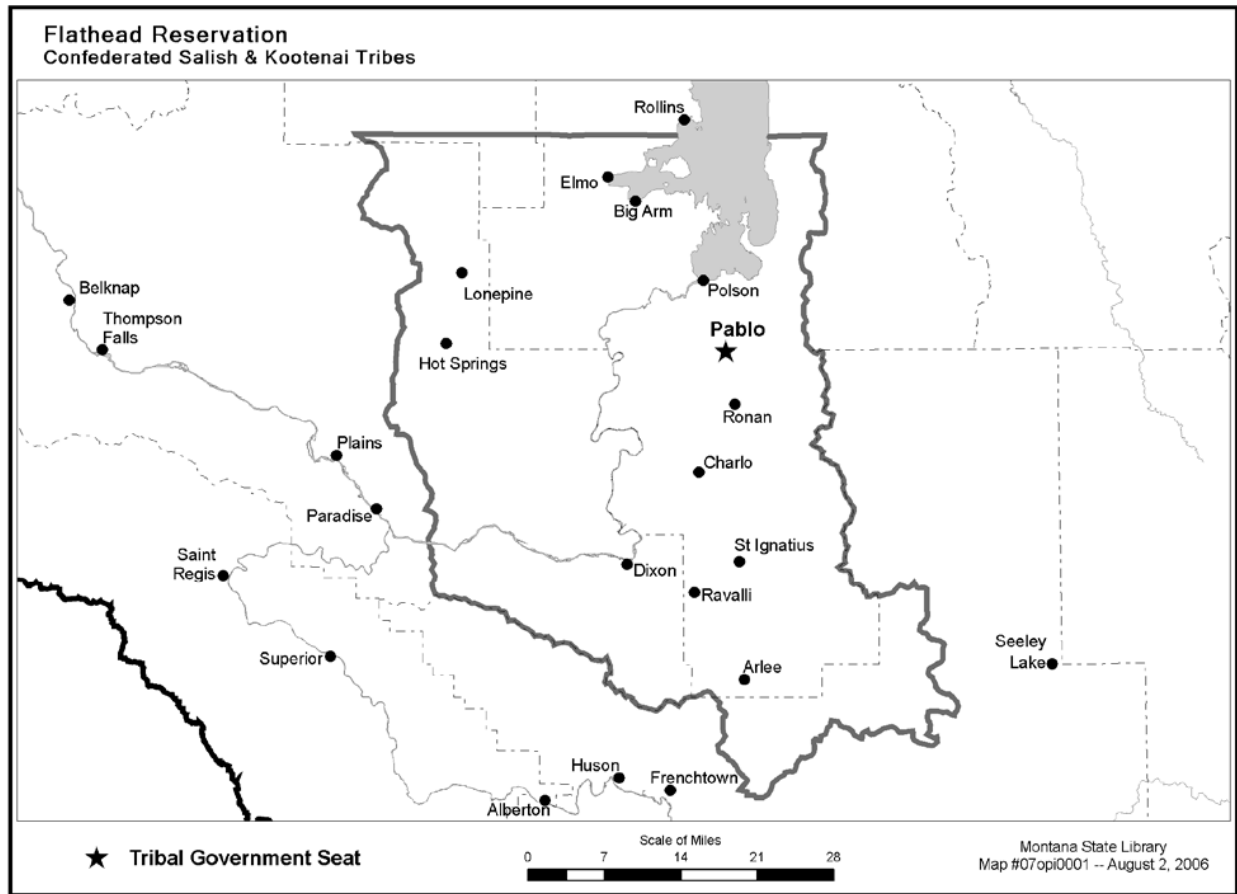
Tribally owned lands 404,172 acres

Fee title or state lands 709,167 acres

Government lands 1,135 acres

In 1973 over 31 percent of the land was owned by non-Indians. The Crow Indians operate only a small portion of their irrigated or dry farm acreage and only about 30 percent of their grazing land. More authority for the leasing of land without supervision has been extended to the Crow Tribe than to any other Indian tribe in Montana. Special legislation regarding Crow land in 1920, known as the Crow Act, and subsequent modifications occurring in 1926, 1948, and 1949, allowed most Crow tribal members to contract independent leases for individually owned land.

Flathead Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Flathead Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Flathead Indian Reservation is located in northwestern Montana on the western slope of the Continental Divide. The exterior boundaries of the reservation include portions of four counties—Flathead, Lake, Missoula, and Sanders. The Flathead Reservation land base consists of approximately 1,243,000 acres. The eastern border of the reservation is at the top of the Mission Range of the Rocky Mountains. Flathead Lake and the Cabinet Mountain Range are to the north; the Lower Flathead River runs through the heart of the reservation; and to the west are the Salish Mountains and rolling prairie lands.

Population

The three tribes of the Flathead Indian Reservation are the Salish, Pend d'Oreille, and Kootenai. Seliñ is the proper name for the Salish, who refer to themselves as Sqéliö—the People. The Salish have often been referred to as “Flatheads,” but this name is a misnomer and, in actuality, there are no Flatheads. Qæispé is the proper name for the Pend d'Oreille. The aboriginal name of the Kootenai Tribe is Kutanaxa, a name that means “licks the blood” in reference to a traditional hunting custom. The term Ktunaxa describes the Kootenai political sovereignty as a nation and all citizens who identify themselves as Kootenai. “Ksanka” refers to the name of the Ktunaxa band of the Flathead Reservation. Ksanka translates, “Standing Arrow,” which is a traditional warring technique. The tribes today are known by the contemporary title of The Confederated Salish and Kootenai Tribes. For the purposes of this document and for reader understanding, the terms Salish, Pend d'Oreille, and Kootenai will be used. After the reservation period, when lands were allotted and then subsequently opened to homesteading in 1910, many non-Indians moved to the reservation. The influx of homesteaders and the continuing movement of non-Indians onto the reservation have resulted in the Confederated Salish and Kootenai People being the minority population on their own reservation. Presently there are many Indian people from other tribes that live on the Flathead Reservation. Many are attending Salish Kootenai College or Kicking Horse Job Corps. Some have intermarried with tribal members and live among the community with their families. Both Salish Kootenai College and local K-12 public schools have identified over 40 different tribal nations represented within the student populations. There are 6,961 enrolled members of the Confederated Salish and Kootenai Tribes. Of this population, 4,244 live on the reservation.

Land

The Hellgate Treaty of 1855 created the Flathead Reservation. The treaty defined the boundaries of the reservation. A formal survey by the government actually diminished the reservation both on the northern and southern ends. The lands that remained as reserved by the treaty are approximately 1,243,000 acres. This land base was soon to change, however, with the passing of the Allotment Act (Dawes Act) of 1887, and the subsequent Homestead Act that opened the reservation to non-Indians in 1910. This resulted in the tribes becoming the minority landowners on their own reservation. While much of the prime agricultural land remains in non-Indian hands, the tribes have been aggressively buying back land. At this time they have become the majority landowners at roughly 56 percent. Following is a breakdown of the current status of reservation lands:

Area in Acres Status

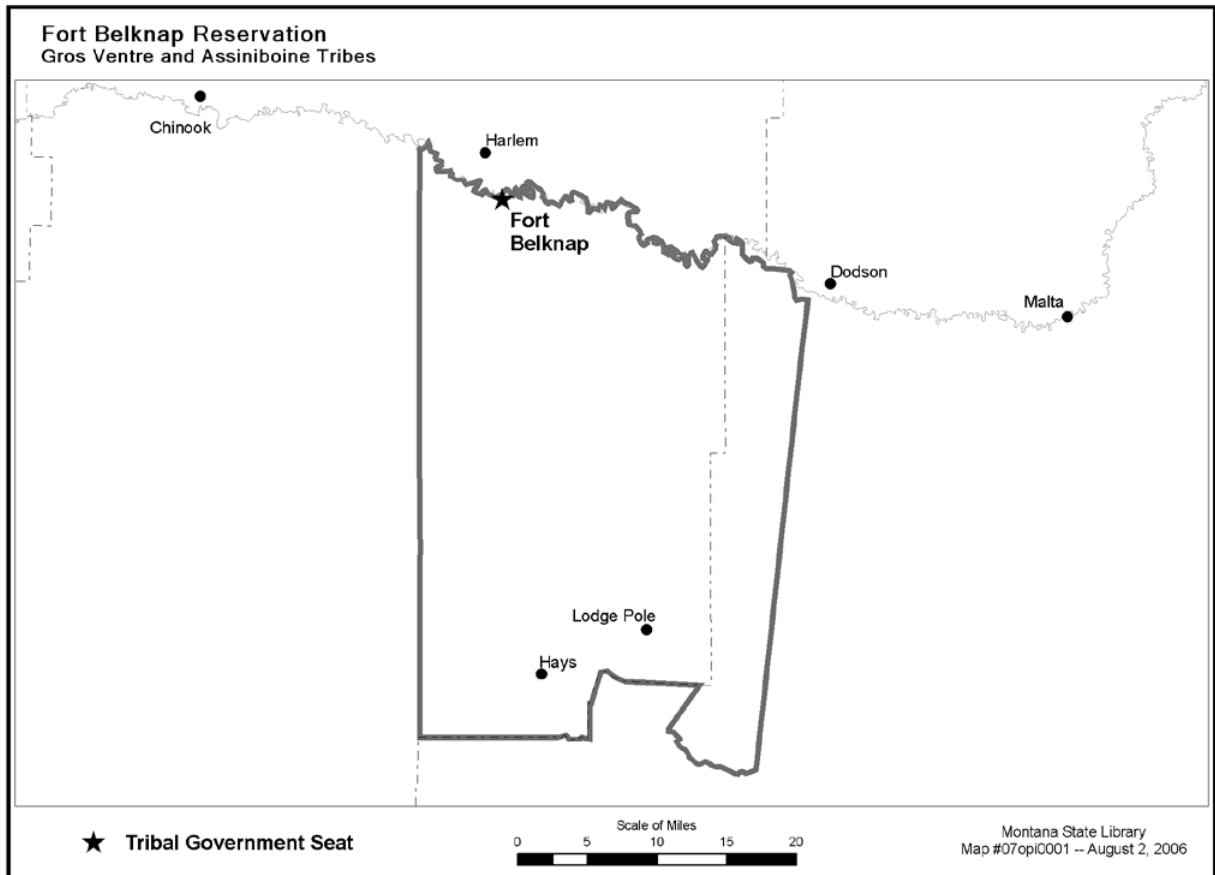
613,273.50 Tribal Trust

76,159.25 Water

58,728.98 Tribal Fee
39,940.56 Individual Trust
4,248.89 Off-Reservation Tribal Fee
466,480.67 Fee

22,466.46 Federal
40,742.57 State
346.42 Town sites

Fort Belknap Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Fort Belknap Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Fort Belknap Reservation is located in north central Montana, south of the Milk River, within Phillips and Blaine Counties. Nearly 92 percent of the reservation is found in Blaine County with the remainder located along the western edge of Phillips County. The reservation's boundaries contain an area of approximately 675,336 acres. In addition, there are 29,731 acres of tribal land outside the reservation's boundaries. The north to south boundary extends 40 miles in length. The width is approximately 26 miles. Most of the northern portion of the reservation consists of the glacial plains and alluvial bottomlands. The southern portion of the reservation drains into the Missouri River and consists of rolling grasslands, river "breaks," and two principle mountain ranges, the Bearpaws and the Little Rocky Mountains. These mountains reach an elevation of approximately 6,000 feet.

Population

Enrolled members living on or near the Fort Belknap Reservation 5,771

Enrolled members living off the Fort Belknap Reservation 1,532

Total number of enrolled tribal members 7,303

There are also Indians from other tribes, mostly Chippewa and Cree, living on the reservation, although they have no interests in tribal assets. Over the years, the reservation's resident Indian population has been decreasing. Some of the decline is due to the rural-urban shift, but a large proportion is a result of young people seeking off-reservation employment and educational pursuits.

Land Status

Total acres within the reservation's boundaries 645,576 acres

Individually allotted lands 406,533 acres

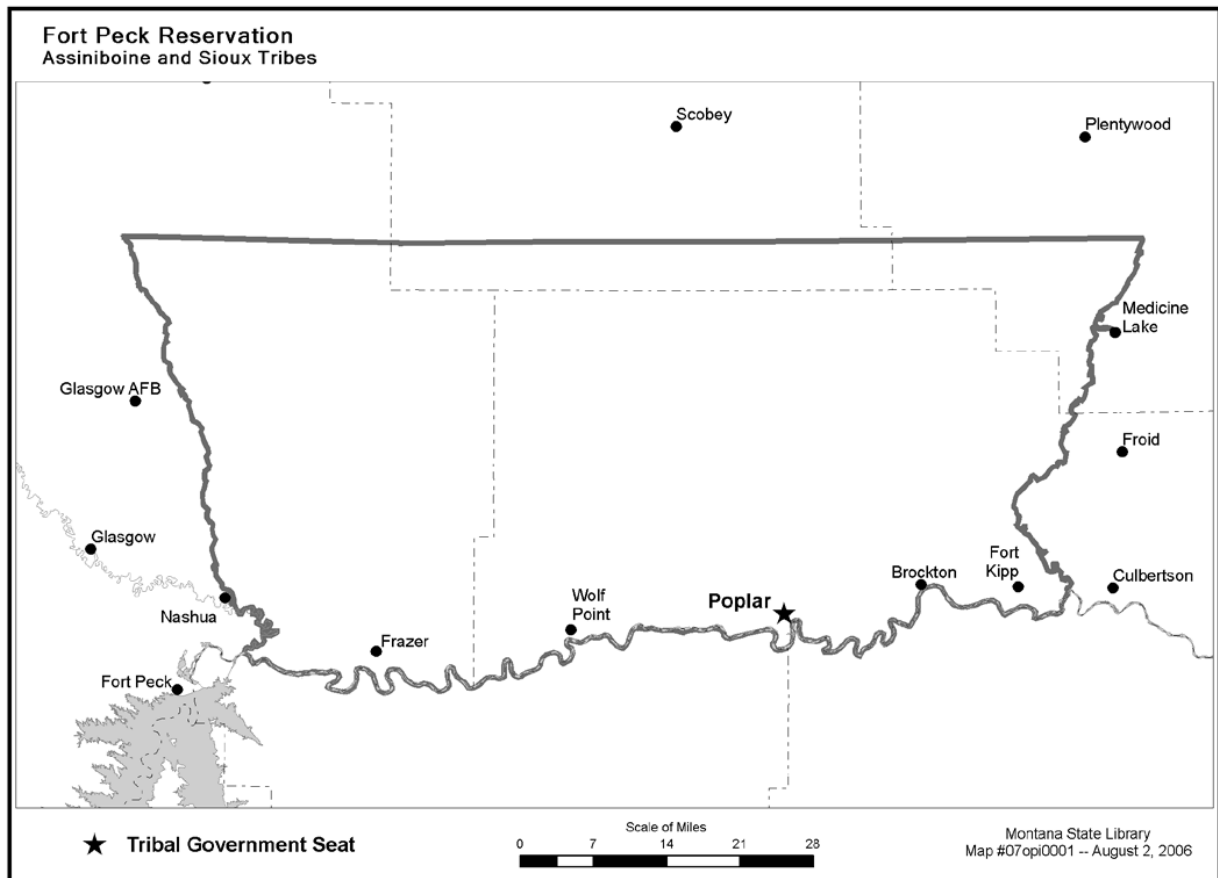
Tribally owned lands 210,954 acres

Fee title or state lands 19,000 acres

Government lands 592 acres

Non-Indian owned 9,000 acres

Fort Peck Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Fort Peck Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

The Fort Peck Indian Reservation is home to a number of different Nakoda (Assiniboiné), Dakota, and Lakota (Sioux) communities that stretch along northeast Montana's Hi-Line from the Big Porcupine Creek to the Big Muddy Creek. The reservation, Montana's second largest in terms of land area, consists of 2,093,318 acres of which just under half is owned by individual tribal members or held in common by the Assiniboiné and Sioux Tribes. Linguistically, the Nakoda, Dakota, and Lakota are related. Sometime in the late 16th century they resided in the region between the Mississippi River and Lake Superior. As pressure from eastern tribes increased, the Nakoda split from the other Dakota and Lakota groups and moved north into Cree country. Today, bands of Nakoda, Dakota, and Lakota reside in Frazer, Oswego, Wolf Point, Poplar, Brockton, Riverside, and Ft. Kipp. These communities lay along the Missouri River's north bank, the reservation's southern boundary. Wolf Point, with a population of 4,000, is the largest town on the reservation and serves as the reservation's commercial center. Poplar, the next largest community, has a population of 3,200. Poplar is also the center of tribal government. The Ft. Peck Tribes, the BIA, and the Indian Health Service are headquartered there, as well as a number of other federally funded programs. The nearest primary trade centers are Billings, Great Falls (both approximately 300 miles from the reservation), and Williston, North Dakota, which lies some 75 miles east of Poplar.

Population

Enrolled Sioux members 6,962

Enrolled Assiniboiné members 4,209

Total Ft. Peck tribal members 11,171

There are close to 1,000 members of other tribes living on Ft. Peck Reservation. One of the largest non-enrolled tribal groups is the Chippewa from the Turtle Mountain Reservation in North Dakota. The next largest non-enrolled group is the Assiniboiné from Ft. Belknap followed by individuals from the Three Affiliated Tribes (Mandan, Hidatsa, and Arikara) in North Dakota, and a number of Canadian Assiniboiné.

Land Status

Total reservation acreage 2,093,124

Total tribal acreage 413,020

Total individually allotted acreage 516,092

Total fee simple or state acreage 1,164,012

The Ft. Peck Tribes have instituted an active policy of land acquisition. Over the past 20 years the Tribes have acquired over 19,000 acres. Ft. Peck, like most reservations, experienced the allotment policy, which resulted in the loss of just over half of tribal land holdings. Although the Dawes Act was enacted in 1887, it wasn't until the early 1900s when Ft. Peck was allotted. By 1922 the allotment process was near completion and lands not allotted were opened up for homesteading by non-Indians. Again, like most reservations, much of the better cropland passed into non-Indian hands. During the Depression, many non-Indian farms failed and the government repurchased the lands. An Act of Congress returned much of that land to the tribes in 1975.

Little Shell Tribe of Chippewa Indians of Montana

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

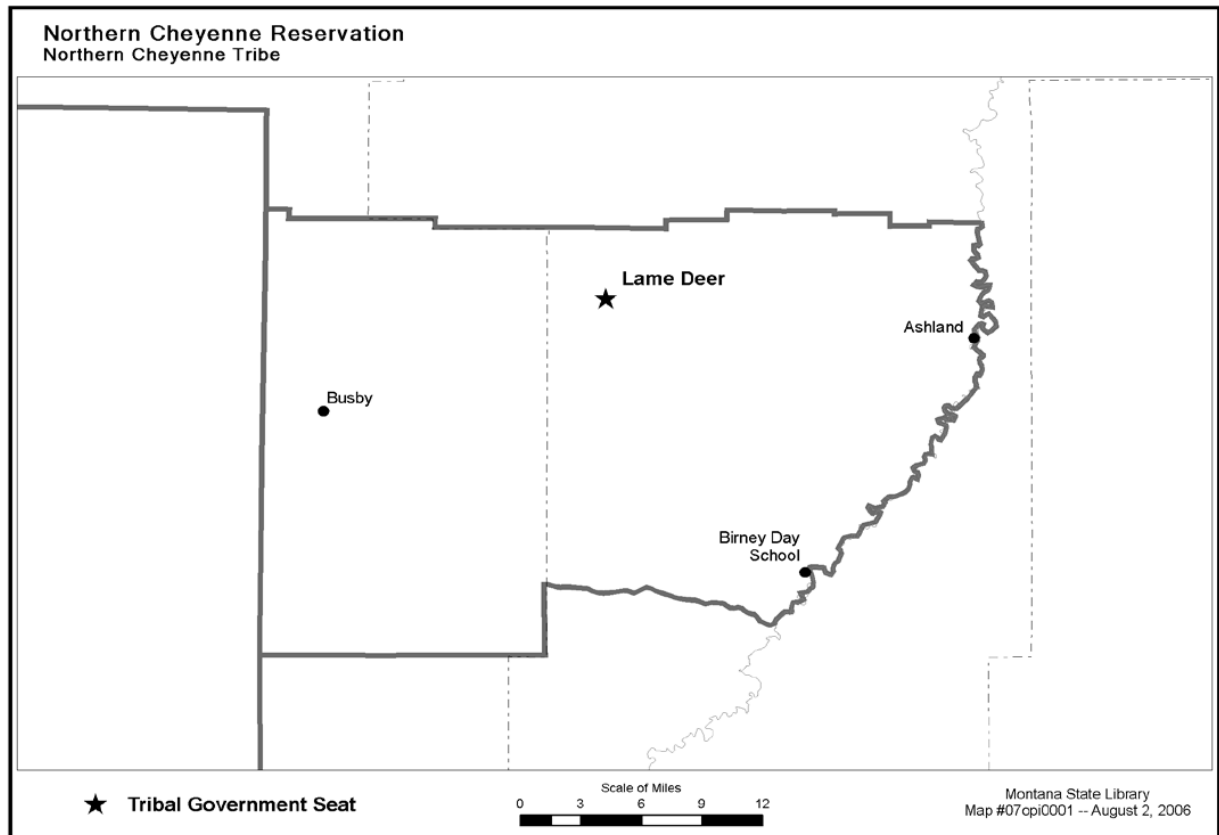
Location

The Little Shell Chippewa Tribe is without a reservation or land base and members live in various parts of Montana. There are population concentrations in Great Falls, Havre, Lewistown, Helena, Butte, Chinook, Hays, Wolf Point, Hamilton, and Billings, as well as numerous other small communities in the state. Because the tribe has been without a land base for over 100 years, many members and their descendants live outside of Montana. Many changes are expected during the next decade as federal recognition is implemented.

Population

The name of the tribe is: "The Little Shell Tribe of Chippewa Indians of Montana," and it is often shortened to "Little Shell." The name "Métis" (pronounced may-tee) is often used, meaning "middle people" or "mixed blood." The term Métis or more correctly Métifs, was first used during the 18th and 19th centuries, but at that time it identified a specific Northwest society with its own culture and economic traditions, living in the areas of the Red River, the Saskatchewan River, Turtle Mountain, North Dakota, and the area of present day Winnipeg and Pembina, North Dakota. A further discussion regarding this group is found in the subsequent section titled Ethnography and Historical Background. The current population of enrolled tribal members in Montana is approximately 3,850 and that number has not changed much in recent years. The tribe maintains only a rented office with volunteer staff, but continues to struggle for federal recognition. The Métis number in the thousands in the United States and south central Canada, and there are many unenrolled Little Shell people in Montana. Exact population numbers are not available. In the mid 1800s the tribe was numbered at several thousand in the Red River-Pembina region. At that time there was no formal enrollment procedure, no reservation and thus no documented population figure. After the 1892 renegotiation of the Treaty of 1863, (the infamous 10 cent treaty) many of the Métis, including the Band of Chippewa under Little Shell, were left without a land base or reservation, and many became nomadic.

Northern Cheyenne Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Northern Cheyenne Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Northern Cheyenne Reservation, situated in southeastern Montana, lies within the counties of Big Horn and Rosebud. The Crow Reservation borders it on the west. The reservation consists of open ponderosa-pine plateau and valley country with an annual rainfall of approximately 16 inches. The topography ranges from about 4,800 feet to a low of a little less than 3,000 feet. The reservation headquarters and the center for business activities and population are in Lame Deer. The reservation itself is divided into five districts; Busby, Lame Deer, Ashland, Birney, and Muddy.

Population

Total number of enrolled tribal members Approximately 7,374

Even though there are over 7,000 enrolled members, about 4,199 members live on the reservation scattered through the five district communities. There is also a relatively small population of non-Indians and other tribal members living on the reservation.

Land Status

Total acres within the reservation's boundary 444,774.50 acres

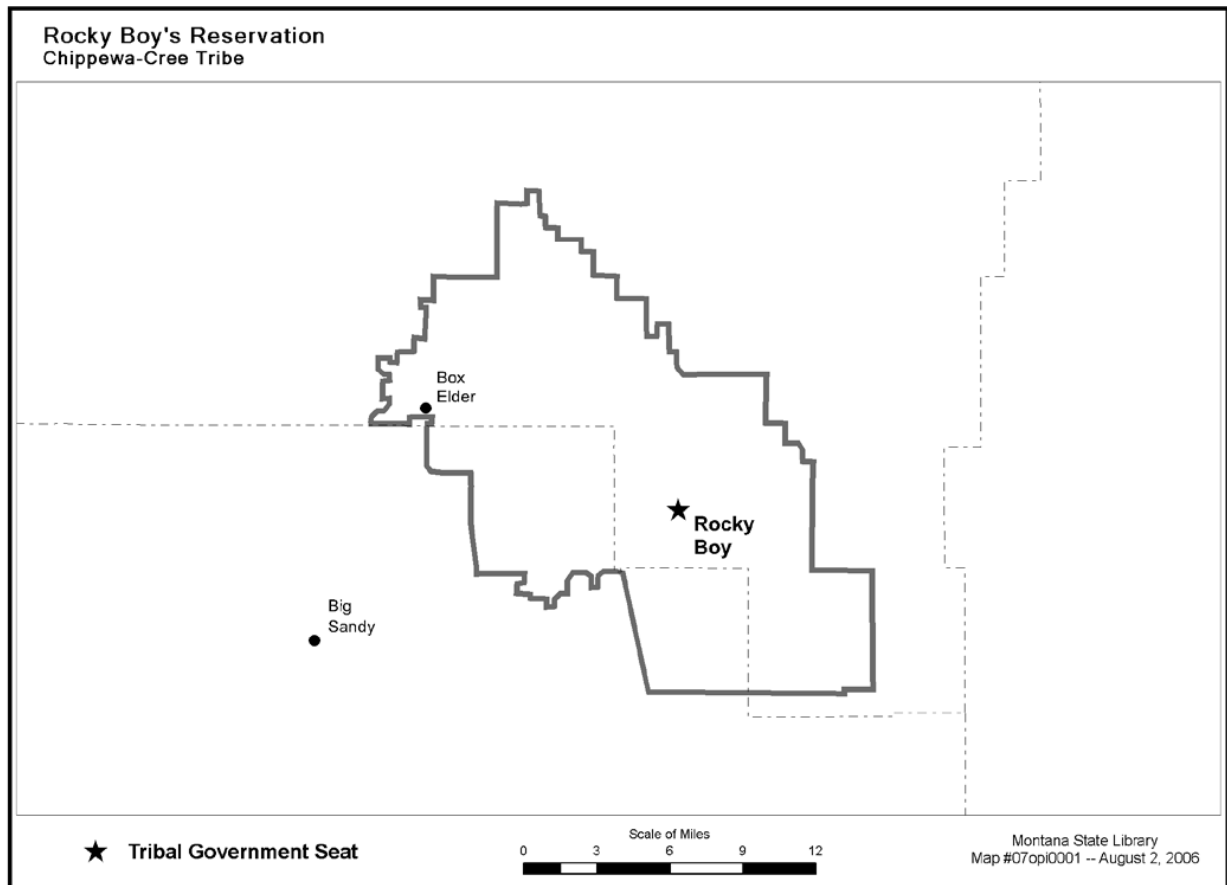
Individually allotted lands 113,277.70 acres

Tribally owned lands 326,546.81 acres

Fee title or state lands 4,827.70 acres

Non-Indians own about 30 percent of the fee or state lands on the Northern Cheyenne Reservation. The Tribal Council has selected a Land Acquisitions Committee whose primary policy is directed to the purchase of land into Tribal ownership. The Committee thus assures that Indian land is retained in Indian ownership.

Rocky Boy's Reservation



<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Rocky Boy's Reservation

<http://www.opi.mt.gov/pdf/IndianEd/Resources/MTIndiansHistoryLocation.pdf>

Location

The Rocky Boy's Indian Reservation is located in north central Montana, taking in portions of both Hill and Choteau counties. The reservation lies 90 miles south of the United States-Canadian border near the boundary separating the provinces of Alberta and Saskatchewan. The city of Havre (pop. 12,000) is located 26 miles to the north. U.S. Highway 87 between Havre and Great Falls intersects the reservation at Box Elder. Reservation roads total 216 miles with 62 providing well-paved, easy access to major points throughout the reservation. Airport facilities in Havre and Great Falls provide commercial airline services. Rail service, including Amtrak, is available in Havre on the main east/west line of the Burlington Northern Railroad; a south spur adjoins the reservation. Mt. Baldy, Mt. Centennial and Haystack Mountain are the more prominent landmarks found within the boundaries of the reservation. All three maintain significance in one way or another for the Chippewa Cree. East Fork and Bonneau Dams are also popular recreational areas. There is no town site on the reservation. The community of Rocky Boy is truly rural in every sense of the word. Rocky Boy's Agency is the hub of all reservation activity and serves as headquarters for the Chippewa Cree Tribe. The Rocky Boy Reservation is the smallest reservation in the state of Montana and the last to be established.

Population

The reservation's unusual name comes from the leader of a band of Chippewa Indians. Translated from the Chippewa language it means Stone Child, but the original translation was lost and the name Rocky Boy evolved. The reservation was established by Executive Order in April of 1916, when Congress set aside 56,035 acres for the Chippewa and Cree Bands of Chief Rocky Boy. In 1947 the reservation was expanded by 45,523 acres, bringing it to nearly its current size. None of the land has been allotted, though some individual assignments have been made. The ethnic origin of the residents of the Rocky Boy's Reservation has remained complex, with the reservation becoming home to a diverse group of Cree, Chippewa, Métis, and Assiniboine peoples. The Cree represent one of the largest Native American groups in North America. While primarily residing in Canada today, a group of Cree settled in northern Montana after the Riel Rebellion in 1885. Led by Little Bear, these Cree eventually, after some three decades, became associated with a band of landless Chippewa under the leadership of Stone Child or Rocky Boy. The principal use of lands within the reservation is grazing and dry land farming. There is no substantial industry with the exception of a few small family-owned businesses. Although the reservation is isolated from larger metropolitan areas, community residents are avid participants in church; community and school related activities, such as basketball games. This extreme isolation also accounts for the rich cultural heritage continuing on the Rocky Boy's Reservation.

Land

Rocky Boy's Reservation was established by Executive Order in 1916. Along with the passage of the 1934 Indian Reorganization Act, the Chippewa Cree Tribe had the opportunity to acquire the remaining land base, which consisted of area farm operations that had been abandoned during

the depression era, thereby bringing the reservation land base to the current 122,259 surface acres. Rocky Boy's Reservation is unallotted and is held in trust for the entire tribe. The reservation's resource base consists of farm and range lands, minerals, timber stands, and the Bear Paw Mountains which sustain wild game, fish, waterfowl, and springs and creeks that converge to form seven major drainages. The reservation has three distinct topographic zones including the Bear Paw Mountains in the southeastern portion, central rolling foothills and semi-arid plains in the north. The reservation is also split by Hill County covering the northeast and Choteau County covering the southwest portion of the reservation. Reservation topography is dissected, showing glacial plains and volcanic outcroppings. Small perennial streams arise in the Bear Paw Mountains, cutting steep sloped valleys. Elevation on the reservation ranges from 2,500 on the plains to 6,916 feet on top of Baldy Mountain. The average annual precipitation ranges from 10 inches at the lower elevations to 20 plus inches at the higher elevations. Temperature extremes are commonly from 110 degrees to -35 degrees Fahrenheit. Winters are long and cold and the roads are narrow and treacherous, particularly in the winter months.

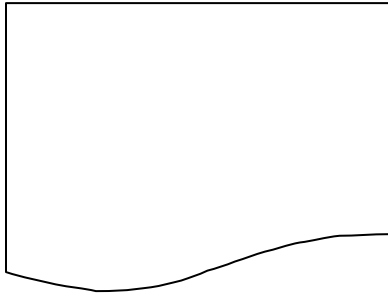
Irregular Shapes

Name _____

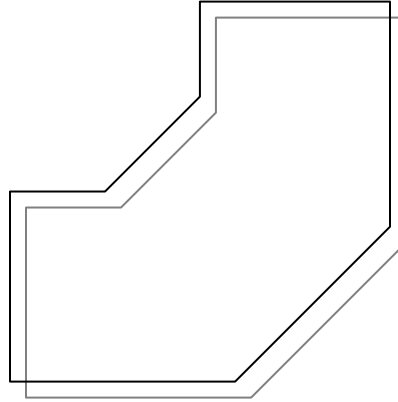
Below are several irregular shapes. Please complete the following for each:

- Decide how to sketch commonly used polygons over the top of the irregular shape to best estimate the area of the figure. **Draw** the division lines in the diagram.
- Identify the formula(s) of the common polygonal shapes you will use to calculate the estimated the area.
- Find the appropriate measurements needed to calculate the area of the shape. Indicate your unit of measure in your calculations.

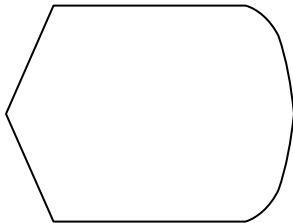
1.



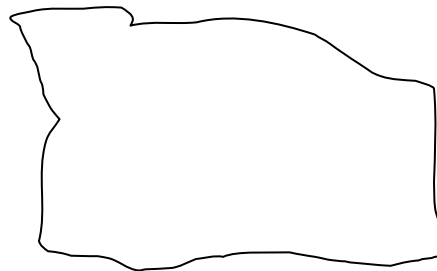
2.



3.



4.



Irregular Shapes (Key)

Below are several irregular shapes. Please complete the following for each:

- Decide how to sketch commonly used polygons over the top of the irregular shape to best estimate the area of the figure. **Draw** the division lines in the diagram.
- Identify the formula(s) of the common polygonal shapes you will use to calculate the area.

Most of the shapes provided can easily be divided into rectangular, triangular, and trapezoidal regions. There will need to be discussed that approximation is necessary when drawing in the divisions as very few divisions of irregular shapes work well.

Rectangle: $\text{base} \times \text{height}$

Triangle: $0.5 \times \text{base} \times \text{perpendicular height}$

Trapezoid: $0.5 \times (\text{short base} + \text{long base}) \times \text{perpendicular height}$

- Find the appropriate measurements needed to calculate the area of the shape. Indicate your unit of measure in your calculations.

Approximate Areas:

1. 2.6 in^2
2. 2.7 in^2
3. 1.4 in^2
4. 2.5 in^2

Reservation Land Acreage Worksheet

Name _____

Reservation Assigned _____

1. What are some ways common polygonal shapes were used to estimate the area of the irregular shapes?
2. Did some the common polygonal shapes used to estimate the area require more measurements than the shapes you used?
3. How did you decide what unit of measure you would use? Examples: Measure to the nearest $\frac{1}{4}$ inch, $\frac{1}{2}$ inch or tenth of a centimeter. You should write your estimated area answer using the same corresponding units. How would your answer have differed if you had changed your nearest unit of measure?
4. What shapes did you use estimating the area of your reservation?
5. Was your area comparable to the rest of your group members? Was your value larger or smaller than the other members?
6. What is your group's agreed upon area of your reservation? Explain how you determined which value to use.
7. Calculate your reservation's acreage using the appropriate unit conversion.

8. How does your acreage calculation compare to the reported acreage amount? Where might the differences have come from?

9. Write a convincing argument as to whether your calculated acreage should be accepted. Your argument needs to address the percentage of difference between the calculations and the reported value.

Reservation Land Acreage Worksheet

Suggested Teacher Answers

1. What are some ways the irregular shapes were divided to calculate the area?

These will depend upon the student's individual choices. Most of the irregular shapes will be divided into rectangles, triangle, and trapezoids.

2. Did some of the ways for dividing the shapes require more measurements than the way you divided your shapes?

Once again this will depend upon what the students' choices were. Trapezoidal division does require a few more measurements.

3. How did you decide the precision you should write your area calculation answer in? Does it matter what precision you use?

It is very important that students remember to use the scale on their map in their measurements. Students were allowed the choice of measuring in inches or centimeters. They need to keep in mind that they can not report an answer of area more precise than their original measurements were in.

Example: triangle with sides 3.4 cm by 3.6 cm should report the area as 6.1 square centimeters NOT 6.12 square centimeters. Students tend to write down however many decimal values their calculator gives them instead of thinking of significant digits.

4. What shapes did you use in calculating the area of your reservation?

This will be specific to the shape of their assigned reservation and personal choice.

5. Was your area comparable to the rest of your group members? Was your value larger or smaller than the other members?

Answer dependent upon the results of their group. Variations will be from different division of the reservation and possibly the differences in measurement choice. No matter which way the group measured or if some group members used cm and others used inches. The final area results when converted to square miles and acres should be close.

6. What is your group's agreed upon area of your reservation? Explain how you determined which value to use.

Some groups may say that they used the average of their areas (especially if they all used the same unit for measuring).

7. Calculate your reservation's acreage using the appropriate unit conversion.

Here you may need to remind students of the unit conversions.

1 inch = 2.54 cm

12 inches = 1 foot

5280 feet = 1 mile

1 square mile = 640 acres

For example: **Rocky Boy Reservation** 208 square miles for 133,120 acres

8. How does your acreage calculation compare to the reported acreage amount? Where might the differences have come from?

The reported acreage of the Rocky Boy Reservation is 122,259 surface acres. There is a difference of 10,861 acres or an estimate that is 8.9% larger than reported. The differences are due from the estimation of the shapes the area was broken up into when calculating the acres. Depending upon the precision students measured, the error can increase as the area is a squared calculation.

9. Write a convincing argument as to whether your calculated acreage should be accepted. Your argument needs to address the percentage of difference between the calculations and the reported value.

The calculations were completed for a Montana Road Map and not the copies of maps included with the lesson. Reasonable square mile & acreage numbers by reservation:

- **Rocky Boy:** 208 square miles for 133,120 acres. There are approximately 2,500 enrolled members of the Chippewa-Cree tribe living on the reservation
- **Crow:** 3,406 square miles for 2,179,840 acres. There are approximately 5250 (75% of the 7,000 enrolled members) that live on or near the reservation.
- **Northern Cheyenne:** 648 square miles for 414,720 acres. Approximately 5,000 Northern Cheyenne, along with members of other tribes and non-Native Americans that live on the reservation.
- **Flathead:** 2,062 square miles for 1,319,680 acres. Over 4,000 Salish, Kootenai, and Pend d'Oreille of nearly 7,000 members live on the reservation.
- **Fort Belknap:** 974 square miles for 623,360 acres. A combined enrollment of the Assiniboiné and Gros Ventre is about 2,800.
- **Fort Peck:** 3221 square miles for 2,061,440 acres. About 6,800 Assiniboiné and Sioux live on the Fort Peck Reservation.
- **Blackfeet:** 2,145 square miles for 1,372,800 acres. About 7,000 Blackfeet tribal members live on the reservation.